

Claims

What is claimed is:

1. A method for forming a highly conductive, substantially transparent film on a substrate,  
5 comprising:  
providing a substrate;  
depositing on the substrate, at a temperature of 120 °C or less, a layer of amorphous  
and/or polycrystalline conductive material which is substantially optically transparent to  
visible wavelengths in its crystalline state; and  
directing pulsed energy onto the layer of conductive material to crystallize it and  
form the highly conductive, substantially optically transparent film.

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2. The method of claim 1, wherein the step of providing a substrate further comprises  
providing a substrate composed of a material selected from the group consisting of PET, PEN, PC,  
PAR, PEL, PES, PI, Teflon PFA, PEEK, PEK, PETFE and PMMA.

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3. The method of claim 1, wherein the step of providing a substrate further comprises  
providing a substrate coated with an optically transparent thermal insulating layer.

4. The method of claim 3, wherein the thermal insulating layer further comprises an oxide, a  
nitride and/or a polymer.

5. The method of claim 1, wherein the layer of conductive, transparent material is selected from the group containing Indium Tin Oxide, Zinc Stannate, Cadmium Stannate, Zinc Indium Oxide, Magnesium Indium Oxide and Gallium Indium Oxide.

5 6. The method of claim 1, wherein the step of depositing the conductive material on a surface  
of the substrate further comprises depositing the conductive material by sputtering, reactive  
sputtering, evaporation, reactive evaporation, chemical vapor deposition or plasma enhanced  
chemical vapor deposition.

7. The method of claim 1, wherein the step of directing pulsed energy onto the layer of conductive material further comprises the steps of:

generating an energy pulse from a laser, an electron beam source or an ion beam source; and  
directing the energy pulse onto the layer of conductive material.

8. The method of claim 7, wherein the step of generating an energy pulse further comprises generating an energy pulse from an excimer laser or a YAG laser.

9. The method of claim 7 wherein the step of directing an energy pulse further comprises  
20 directing an energy pulse having a wavelength of between 200 and 400 nm onto the layer of  
conductive material.

10. The method of claim 9, wherein the step of generating an energy pulse further comprises generating an energy pulse from an excimer laser.

11. The method of claim 9, wherein the step of generating an energy pulse further comprises  
5 generating an energy pulse from a YAG laser.

12. A composite material for use in fabricating semiconductor display devices, comprising:  
a substrate that is intolerant of temperatures greater than 350°C; and  
a layer of crystalline material that is highly conductive and substantially optically transparent to visible wavelengths on one surface of the substrate.

13. The composite material of claim 12, wherein the substrate is a material selected from the group consisting of PET, PEN, PC, PAR, PEL, PES, PI, Teflon PFA, PEEK, PEK, PETFE and PMMA.

14. The composite material of claim 12, wherein the layer of conductive, transparent material is selected from the group containing Zinc Oxide, Indium Tin Oxide, Zinc Stannate, Cadmium Stannate, Zinc Indium Oxide, Magnesium Indium Oxide and Gallium Indium Oxide.

20 15. A composite material for use in fabricating semiconductor display devices, comprising:  
a substrate that is intolerant of temperatures greater than 350°C;  
a layer of thermal insulating material that is substantially optically transparent at visible wavelengths on one surface of the substrate; and

a layer of crystalline material that is highly conductive and substantially optically transparent at visible wavelengths on the opposite surface of the layer of insulating material from the substrate.

5 16. The composite material of claim 15, wherein the layer of insulating material further  
comprises one or more layers of an oxide, a nitride and/or a polymer.

10 17. The composite material of claim 15, wherein the substrate is a material selected from the  
group consisting of PET, PEN, PC, PAR, PEL, PES, PI, Teflon PFA, PEEK, PEK, PETFE and  
PMMA.

15 18. The composite material of claim 15, wherein the layer of conductive, transparent material is  
selected from the group containing Zinc Oxide, Indium Tin Oxide, Zinc Stannate, Cadmium  
Stannate, Zinc Indium Oxide, Magnesium Indium Oxide and Gallium Indium Oxide.